INVESTIGATION OF COBALT AND COPPER POTENTIAL OF THE UPPER KONESS RIVER AREA, NORTHEASTERN ALASKA.

By D. D. Southworth and J. C. Barker

Critical and Strategic Minerals in Alaska -

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James G. Watt, Secretary

BUREAU OF MINES

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INTRODUCTION

A brief mineral investigation of possible cobalt and copper mineralization in the upper Koness River area (figure 1) of northeastern Alaska was made by the Alaska Field Operations Center (AFOC), U.S. Bureau of Mines. The work was part of an Alaska-wide assessment of 'critical and strategic' minerals. It follows up on geochemical anomalies revealed during the Bureau's 1977 study of lands proposed for classification under section 17(d)(2) of the Alaska Native Claims Settlment Act (1, p. 95-99)[3/]. The following is a summary of field work in 1981 and will be updated if additional work is undertaken. Specific objectives of this investigation were to (1) re-verify the geochemical anomalies, (2) conduct a 'next-level' of more detailed stream-sediment and/or soil geochemical sampling to better define areas of possible interest, (3) make basic observations of the hydrologic environment, and (4) conduct geologic mapping and examination of bedrock outcrops for their mineral potential.

3/ Underlined numbers in parentheses refer to items listed in the reference section of this report.

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HISTORY AND PREVIOUS INVESTIGATIONS

Topography of this remote region of the eastern Brooks Range has been mapped only at reconnaissance scale (1:250,000). There have been no mining claims recorded in the area and there is no record of geologic reconnaissance by the mineral exploration industry. No prospectors are known to have worked in the area. The only known previous minerals-related work in the region is that done by AFOC in 1977. Samples collected during that project were further analyzed for 32 elements (including cobalt) by the Dept. of Energy (3). The present report is based primarily on those sample results.

OWNERSHIP

The entire area concerned in this report lies within the recent addition to the Arctic National Wildlife Range and is administered by the Fairbanks office of the U. S. Fish and Wildlife Service, U.S. Department of the Interior.

PHYSIOGRAPHY

The report area (figure 2) is within a region of largely open tundra and muskeg. There are very limited growths of willow and alder which are restricted to the lower valleys. Hilltops reach elevations of approximately 5000 ft. Rock exposure is fairly abundant both as rubble and as occasional hillside bedrock outcrop above 3500 ft elevation. Good exposures of bedrock are also found along some stream drainages in the western portions of the study area. The eastern region is mostly covered with tundra and muskeg.

Creeks in the area vary markedly in character, from boggy tundra seepages to clear, gravel-bottomed streams cutting bedrock. In general, creeks which drain areas underlain by shale are more prone to be boggy.

Permafrost is believed to be continuous at these latitudes, however no features such as solifluction lobes, polygon patterned ground or pingos, typical of areas underlain by permafrost, were observed. Quaternary glaciation and lack of deep silt/loess may be responsible for the apparent lack of permafrost characteristics. A few moraines were observed, and it appears that glaciofluvial and morainal material underlies most or all of the lower slopes and valley bottoms. Only rudimentary antiplanation terraces were evident.

ACCESS

Access to the area was by helicopter (Jet Ranger 206-B) from Fort Yukon, approximately 130 mi to the south. It was necessary to carry an additional 12 gal of fuel on board the helicopter to assure sufficient fuel for the round trip. The helicopter was equippd with tundra pads for landing on the muskeg.

There are two small lakes within a few miles of the 1981 campsite. It is possible that these lakes could be used by a small float plane. The lakes are small, but the approaches are clear of obstructions.

Arctic Village lies approximately 20 mi to the west and could be used as a staging area, but only if equipment and supplies were well-guarded, as thievery, vandalism, and drunkeness is rampant in the village.

There are good campsites with adequate firewood (alder) on the banks of the Koness River, but there is little firewood elsewhere. At the time of the visit (mid-August), there was ample water in all of the creeks.

REGIONAL GEOLOGY

Previous geologic mapping at reconnaissance scale (1:250,000) was done by Brosge and Reiser (2). The rock units which underlie the area of interest are listed therein as being of unknown age and stratigraphic correlation.

Within the study area, rock units consist of maroon and green cherty argillites, gray to black chert, black carbonaceous shale, limestones and a few fine-grained mafic dikes and sills. It is possible this group of rocks is transistional to the Christian mafic complex (1, p. 95). Thrust sheets of Devonian graywacke and sandstone lie structually above these units and are exposed on some of the hill tops.

WORK BY THE BUREAU OF MINES

FIELD WORK

A brief investigation of the upper Koness River area was made in early August, 1981. Work was conducted by a two-man team working on foot from a tent camp on the Koness River. A total of fourteen man-days were spent mapping and collecting geochemical samples. Areas up to 6-7 mi from the camp were examined.

An area of roughly 35 sq mi was 'approximately' mapped onto photo enlargements of 1:250,000 scale topographic maps (figure 3).

A total of 106 samples (figure 4) were collected for geochemical analysis. Additional samples were collected for thin section examination and mineral specimens.

SAMPLING AND ANALYTICAL PROCEDURES

Stream-sediment samples (table 1) were collected by hand or with a steel shovel from the finer sandy portion of the active stream channel. Organic-rich material was avoided whenever possible. Samples were placed in water-resistant paper sample bags and air-dried before screening at -80 mesh. Float rock and stream characteristics were noted and recorded at each sample station.

Soil samples (table 2) were collected from the "B" horizon at depths of 4 in to 10 in. Below this depth the ground was usually frozen.

Rock samples (table 3) were usually taken as random chip samples across a geologic unit of interest: for example, a suspected mineralized area or a zone of alteration. The outcrop characteristics of the area covered by the chip sample was recorded. If a sample consisted of

TABLE 1. - Geochemical analyses of stream sediment samples from the upper Koness River area[1]

	All values in parts per million (ppm))						
Sample No.	Ag	Co	Cu	Mn	Mo	Pb	Zn
AW19502	0.2	37	66	---	3	44	175
AW19505	NA	21	--	NA	NA	NA	NA
AW19508	NA	16	--	145	NA	NA	NA
AW19509	NA	17	--	730	NA	NA	NA
AW19510	2.0	18	150	NA	29	50	210
AW19516	0.3	9	43	NA	<2	32	88
AW19517	NA	25	--	NA	NA	NA	NA
AW19520	0.4	37	62	315	2	40	200
AW19523	0.3	34	51	720	3	42	160
AW19526	NA	24	34	NA	<2	35	195
AW19527	0.5	26	140	NA	15	42	184
AW19538	---	38	36	NA	4	52	
AW19529	0.6	8	105	NA	<2	30	135
AW19532	0.4	17	110	NA	9	42	180
AW19533	---	60	210	NA	26	44	590
AW19534	1.6	35	85	NA	9	42	165
AW19535	0.3	13	42	NA	5	40	130
AW19536	0.3	43	29	NA	2	36	110
AW19539	1.0	27	135	NA	29	56	130
AW19542	---	16	140	NA	10	39	225
AW19545	0.5	17	80	NA	6	38	140
AW19548	0.7	33	145	NA	5	34	160
AW19549	0.6	23	54	NA	2	37	135
AW19550	0.5	18	85	NA	16	42	200
AW19551	2.6	6	83	NA	2	22	295
AW19552	0.3	35	61	NA	6	37	185
AW19553	0.4	25	66	NA	3	38	350
AW19555	1.3	17	84	NA	5	36	260
AW19556	0.3	25	135	NA	9	46	245
AW19558	NA	22	155	NA	9	40	230
AW19559	0.9	15	46	NA	2	42	170
AW19560	0.3	25	38	NA	3	35	235
AW19562	NA	43	61	NA	4	39	150
AW19563	0.4	32	74	NA	4	42	240
AW19564	1.6	37	68	NA	4	40	420
AW19567	0.5	30	94	NA	3	35	300
AW19568	0.9	17	95	NA	3	29	150
AW19569	0.7	16	72	NA	4	31	130
AW19570	1.5	81	63	NA	2	34	405
AW19577	0.7	28	220	NA	6	49	145
AW19578	---	280	43	NA	3	40	473
AW19580	---	30	51	NA	8	35	98
AW19582	0.6	12	38	NA	2	24	160
AW19583	0.3	17	63	NA	4	32	230
AW19584	0.6	50	150	NA	10	47	320
AW19585	NA	38	100	NA	7	39	---

See footnotes at the end of this table.

Geochemical analyses of stream sediment samples from the upper Koness River area - Continued

Sample No.	(All values in parts per million (ppm)) Ag	Co	Cu	Mn	Mo	Pb	Zn
AW19587	0.9	15	73	NA	5	34	105
AW19588	NA	46	82	NA	5	43	315
AW19590	NA	28	84	NA	3	36	160
AW19592	1.2	19	38	NA	2	39	120
AW19599	0.8	21	77	17,000	6	33	125
AW19600	0.6	92	59	800	5	37	110
AW19602	---	27	80	NA	4	36	230
AW19603	0.3	31	51	NA	3	38	147
AW19605	0.2	14	29	NA	2	35	105
AW19608	---	67	44	NA	4	36	180
AW19609	0.3	73	46	NA	4	35	135
AW19610	0.7	12	61	NA	3	39	58
AW19612	0.9	14	25	NA	<2	34	95
AW19613	0.6	19	74	NA	3	39	130
AW19614	0.2	20	64	NA	6	39	115
AW19615	1.8	19	165	NA	14	39	140
AW19616	0.8	10	70	NA	2	34	71

[1] Analyzed by atomic absorption (AA). Analyses performed by TSL Laboratories, Spokane, Washington.

< less than
-- not detected
NA not analyzed

TABLE 2. - Geochemical analyses of soil samples from the upper Koness River area[1]

Sample No.	Ag	Co	Cu	Mn	Mo	Pb	Zn
AW19506	1.6	17	105	--	80	41	135
AW19507	---	21	---	--	--	--	---
AW19521	1.5	10	110	28	46	44	76
AW19522	---	9	---	--	--	--	---
AW19530	2.2	10	210	--	5	34	170
AW19531	0.2	21	52	--	2	35	114
AW19537	0.3	19	61	--	3	35	150
AW19538	<0.03	27	31	--	3	37	97
AW19540	1.1	7	90	--	3	29	310
AW19541	1.0	11	92	--	5	41	280
AW19543	0.4	17	56	--	7	34	120
AW19544	0.9	15	84	--	20	43	130
AW19546	0.6	25	195	--	18	55	155
AW19554	0.2	39	120	--	11	48	570
AW19565	0.4	15	37	--	3	40	110
AW19566	0.5	10	140	--	3	27	125
AW19573	0.1	18	48	--	4	38	115
AW19574	0.4	14	98	--	6	36	74
AW19575	1.2	13	135	--	7	35	125
AW19576	0.5	25	140	--	6	44	160
AW19597	1.2	18	95	--	3	48	180
AW19601	0.4	30	64	--	3	37	275
AW19604	0.9	15	36	--	2	47	85
AW19606	1.0	19	34	750	3	35	87
AW19607	2.6	18	78	--	70	56	76

[1] Analyzed by atomic absorption (AA). Analyses performed by TSL Laboratories, Spokane, Washington.

< less than
-- not detected
NA not analyzed

TABLE 3. - Geochemical analyses of rock samples from the upper Koness River area

Field No.	Co	Cu	Mn	Mo	Ni	Pb	Zn	Sample Description
AW19501	24	----	-------	--	49	---	---	Green shale with pyrite and associated quartz and chlorite.
AW19503	11	21	-------	<2	23	14	41	Sandstone with chert chips and disseminated sulfides.
AW19511	30	9500	7000	4	29	215	200	Black micaceous shale with patches of malachite, high graded.
AW19512	47	1830	-------	2	74	91	230	Chip sample of shale of AW19511.
AW19513	24	----	-------	--	--	---	---	Massive pyrite from Fe-stained outcrop of shale.
AW19514	31	940	-------	4	58	110	115	Malachite and chalcopyrite in green argillite with quartz stringers.
AW19515	19	850	-------	<2	--	39	58	Similar to AW19514, with 1/16 in. quartz veinlets.
AW19518	35	1450	-------	--	--	---	---	Six in. channel sample across malachite stained horizon in black shale.
AW19547	5	44	-------	<2	--	5	49	Grab sample of black, iron-stained chert.
AW19557	19	28	-------	<2	--	8	99	Faint Mn staining and quartz veinlets in red shale.
AW19571	37	115	-------	<2	--	11	71	Iron and Mn-stained diorite.
AW19579	17	30	-------	<2	--	7	57	Green chert which is interbedded with gray shale and quartzite.
AW19586	23	18	-------	<2	--	13	76	Visible sulfide in medium to fine grained gray shale.
AW19589	33	105	-------	<2	44	12	74	Fine grained gabbro.
AW19591	34	115	-------	<2	47	12	65	Random chip sample of gabbro skree.
AW19593	85	12	180000	2	64	55	105	Finely disseminated sulfides in manganiferous black shale.
AW19594	52	215	130000	9	46	27	165	Black shale unit.
AW19596	41	63	3300	3	77	22	105	Random chip sample of black shale.

[1] Analyzed by atomic absorption (AA). Analyses performed by TSL Laboratories, Spokane, Washington.

< less than
-- not detected
NA not analyzed

an individual highgraded rock, or of float material of unknown origin, this also was noted. Samples collected were approximately 1-2 lb in weight.

A pulverized fraction of each crushed rock sample and a pulverized -80 mesh portion of each stream sediment and soil sample collected was analyzed by standard atomic absorption methods for Ag, Co, Cu, Mo, Pb, and Zn. In addition, a few of the samples were also analyzed for Mn. These analyses were performed by TSL Laboratories of Spokane, Washington.

MINERALIZATION

The investigation was oriented to follow-up on copper, lead and zinc anomalies noted in samples collected during the Bureau's 1977 Eastern Brooks Range D-2 study (1). The investigation was further designed to determine if the area has potential for cobalt mineralization, possibly associated with copper.

For this study a visual scan of the data indicated Zn could be considered anomalous at values greater than 300 ppm, Cu at 100 ppm, and Co at 40 ppm. The black shale unit (figure 5) contained minor visible malachite in several locations (for example, sample locations AW19511, AW19512, AW19518) as did the green argillite (samples AW19514, AW19515). One sample (AW19511) of black shale which dipped at 28° SE and striking N 65° W, was highgraded for malachite and contained 9500 ppm Cu, 215 ppm Pb and 200 ppm Zn, but only 30 ppm Co. Similarly, samples of the green argillite (AW19513, AW19514) highgraded for malachite and chalcopyrite, while containing 940 ppm Cu and 850 ppm Cu respectively, were not anomalous in Co, both samples containing less than 32 ppm Co. None of the copper occurrences was continuous over any measurable length or width. Only four stream sediment or dirt samples (AW19530d, AW19533s, AW19564d,

AW19577s) contained greater than 190 ppm copper, with the highest Cu value of these being 220 ppm (sample AW19577s). The highest value obtained was 590 ppm (sample AW19533s). There were no lead anomalies, the highest value reported being 56 ppm Pb (AW19607d). Cobalt was anomalous (280 ppm, 92 ppm) in two samples (AW19578s, AW19600s, respectively) from streams draining a small hill in the northeastern sector of the study area. Very weak silver anomalies (2.2 ppm to 2.8 ppm) were noted in several localities (AW19551s, AW19530d, AW19607d).

The distribution of anomalous Cu, Co, and Zn values tends to support the 1977 analytical results (1, 3). Samples AW19578 and AW19570 particularly agree with anomalous values found further downstream in 1977 [see AR 2630, 2631, 2632 2633, and 2634 listed in Stablium (__)]. The combined data indicates a source of anomalous metal values underlying the east-west valley and lake, and the low-lying area extending northeastward from there. Rock types underlying this area are not known and are in probable fault contact with bedrock exposed on the hillside to the north and south.

The spatial distribution of virtually all of the Co, Cu and Zn anomalies (see figure 4) suggest that they are associated with the marroon and green cherty-argillites and black shale. The weak silver anomalies may be related to the interbedded shale and sandstone/quartzite unit.

Rock sampling of the stratiform Cu occurrences in the black shales indicated near threshold associated Co values in the range of 30 to 40 ppm. Shale hosted mineralization appears to be the most likely explanation of the geochemical anomalies. It should be noted however, that the samples of the mafic sills also give intrinsic Cu values exceeding 100

ppm and could account for anomalous Cu in sediments. The mafics do not apparently contain unusual levels of Co or Zn, however.

SUMMARY AND RECOMMENDATIONS

The east-west to northeasterly trending tundra area drained by streams from which samples AW19578 and AW19570 (figure 6) should be further mapped in conjunction with soil sampling. No significant mineralization was found during this investigation, although up to 2% Cu occurs in stratiform shale units. This type of mineralization should be sought in the area recommended above.

No other sites are recommended for follow-up study.

REFERENCES

1. Barker, J.C. Mineral Investigations of Certain Lands in the Eastern Brooks Range, 1978. BuMines OFR 37-81, 288 p.

2. Brosge', W.P. and H.N. Reiser. Preliminary Geologic Map of the Arctic Ouadrangle, Alaska. U.S. Geol. Survey Open-File Map 256, 1962.

3. Department of Energy. Report on the Mineral Resource Investigations in Six Areas of Central and Northeastern Alaska. Report No. GJBX-33(80), prepared by Bendix Field Engineering Corporation, Grand Junction, Colorado and U.S. BuMines, AFOC, Fairbanks, Alaska, 1980.

FIGURE 5. - Outcrop of malachite-bearing black shale unit at sample location AW19511.

FIGURE 6. - View of east-west trenching valley which is apparently underlain by shales anomalous in cobalt and copper.